Ghana: Monetary targeting and economic development

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Contents

List of tables

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Abstract

The policy of credit ceilings coupled with the use of imposed velocity in monetary management in Ghana was fraught with failures and undesirable effects during the decade of economic reform (1983–1992). The failures necessitated the removal of credit ceilings and the adoption of indirect control of money supply. An important requirement for monetary management using an indirect control is the determination of the absorptive capacity of the economy as well as the identification of the appropriate intermediate targets, operating variables and policy instruments. An ideal policy instrument is one that can be precisely measured, is achievable by the monetary authorities within a short period of time, serves as a visible signal regarding intent of policy to economic agents, and is related to intermediate targets. This paper proposes a financial programming model (encompassing both demand and supply of money) that may be used to *target* growth in monetary stock, *identify* the key sources of assets and *forecast* the portfolio of the corresponding bank liabilities. The major instruments identified include financial papers (Bank of Ghana and government treasury bills and bonds), discount quotas and reserve ratios. These may be supplemented with directives and moral suasion. The leading indicators for determining whether monetary policy is on track include changes in the rate of foreign exchange and the rate of inflation.

Youngblood et. al., 1992). As a result credit targets are easily achieved. Nevertheless, the targets may have either little or undesirable impact on real economic variables.

Issues, objectives and structure of the paper

The most important questions to answer in monetary management are: How large should be the money supply? What factors should be considered in deciding on the growth in money supply that will be consistent with growth in the GDP? Can monetary policy achieve the joint goal of growth/development and stability? Should M1 be the target variable or M2? What instruments should be used to control monetary targets? In order to address these questions we need to provide a theoretical framework within which to operate. In subsequent sections we attempt to unravel some of these issues from both the theoretical perspective and empirical analysis.

For now, however, it should be noted that quasi-money in Ghana is composed of over 75% savings and less than 25% fixed time deposits including certificates in the primary commercial banks. In the secondary banks, however, for the period 1983–1991, the quasi-money comprises 57.6% of time deposits and 42.4% savings deposits. For both the primary commercial and secondary banks, quasi-money is about 60% savings deposits and about 40% fixed time (monetary) deposits. In this respect, for the primary commercial banks either M1 or the base money may be a proper target. However, for the secondary banks it is not clear whether M1 or M2 is the more appropriate monetary variable to target. It is important to note that the International Monetary Fund (IMF) usually targets M2.

The objective of the paper, therefore, is to propose a financial programming framework that uses the technique of targets and indicators to assist the monetary authority in conducting policy to achieve its macroeconomic goals. The proposed programming framework will be based on the absorptive capacity of the economy, which will be endogenously determined; the institutionalization of indirect measures of control of ultimate targets using operating and intermediate instruments; open market operation; and moral suasion. Section II of the paper outlines targeting requirements and options. This is followed in Section III with some stylized facts of the monetary management process in Ghana during the adjustment era. Section IV gives our proposed targeting framework and Section V deals with implementation and methodology. Next are sections VI and VII, which discuss the use of money demand and supply, respectively, in establishing liquidity targets. The paper concludes with remarks and policy recommendations.

II. Targeting requirements and options

Monetary targeting, as indicated earlier, is an attempt to describe how the optimum monetary policy can be pursued to achieve macroeconomic objectives. An important requirement of the exercise, which has been a source of argument among economists, is the identification of appropriate intermediate targets, operating targets and/or policy instruments. An ideal operating target or policy instrument is one that can be precisely measured, is achievable by the monetary authority within a short period of time, serves as a visible signal regarding intent of policy to economic agents in the financial market and is related to intermediate targets.

The choice of intermediate target is often between money stock and interest rates. Interest rate is the preferred target when the money demand function is unstable; otherwise money stock is considered the appropriate intermediate target (Poole, 1971). Whatever target variable is used for policy purposes must satisfy three criteria: measurability (so that its impact can be correctly ascertained), controllability (so that the central bank can exercise an effective control over it) and predictability (so that the monetary authority can anticipate the effect of the target variable on its objectives.

With the various criteria to be satisfied defined, the next key issue is the options available for targeting growth in money supply – either by rule or discretion. If by rule, then the question is: How is the growth rate to be determined? If by discretion, What variables are to be "aimed for" supposing the desired target is pushed off track by non-policy variables? The options are addressed below.

From the monetary base and multiplier perspective, a central bank can change the level of money supply by changing either the multiplier or the base money. The key elements in the base money are reserves and currency with the non-bank public. But the basic assumption is that the monetary multiplier is stable and predictable. In the case of Ghana, the empirical evidence is that the multiplier (and particularly the currency-deposit ratio) is not stable. (Refer to Table 1). The main reason for the instability over the period in question was the increased currency with the non-bank public and the decrease in the volume of deposits due to imposed credit ceiling. This point will be discussed in more detail in Section III.

Targeting of money supply from the assets perspective requires the decomposition of the money supply into net foreign assets (NFA), revaluation account (RVA), special drawing rights (SDR) allocation and net domestic assets (NDA). The NDA is in turn decomposable into net credit to government, cocoa financing, credit to the rest of the economy and other net assets. The basic assumption of this mode of targeting has been that the velocity of money was constant in the monetary/financial programming module.

Table 1: Multiplier and currency ratio

Year	Multiplier	Currency-deposit ratio
1983	1.91	0.75
1984	1.90	0.65
1985	1.91	0.65
1986	2.09	0.57
1987	2.13	0.54
1988	2.13	0.52
1989	2.08	0.53
1990	2.48	0.39
1991 Q1	2.63	0.41

Source: Youngblood et al. (1992), based on Bank of Ghana data.

In order to decide on the actual level of (or alternatively the growth rate in) money supply, we must have an idea of the key missing link, the "velocity". Velocity may be assumed, but an incorrect assumption can create serious economic problems. We have to estimate it from the money demand (or the liabilities side of the monetary framework). Technically speaking, velocity (the GDP-M2 ratio) is found after the process has ended. However, its (marginal) average over a given period can be deduced from the money demand function, which then should constitute the basis of an increase in money supply for the ensuing year, which in turn must be the basis of the quarterly targets within the year.

Alternatively, the decision on how much money should grow may be derived from the monetary growth rule based on the absorptive capacity of the economy. This solves the problem of exogenous imposition of a constant velocity. It introduces the degree of financial intermediation (DOFI) up front and also anchors expected price inflation at the same time. However, it is important to note that because the DOFI is the average for a given period, comparison of the actual DOFI for each period and for different countries (especially of similar economic features) can provide a clue as to the behaviour of the velocity. By way of example, Ghana's monetary velocity for 1991 was 7.52 times (inverse of 13.3%) and by our money demand function (1970-1992), the velocity at the margin averages 4.40 times (inverse of 22.73%). If the 4.40 is the "true" velocity and the financial programming assumes/uses 7.52, then it should be noted that we are reducing the liquidity requirement of the economy by over 3.12 times. This definitely would reduce the real growth in GDP via the expenditure flow including investment and manufacturing/ processing for export.

III. Stylized facts about monetary management in Ghana during the adjustment era

The goal of financial sector reform in Ghana is to discontinue the system of direct credit controls and initiate a process of indirect monetary control in which financial institutions are at liberty to make decisions on purely economic criteria, subject only to the requirement of sound banking practice and overall control of the money supply by the Bank of Ghana. This means that the Bank of Ghana will have to control the money supply through open-market operations, adjusting banks' reserves through the emerging money markets for short-term Bank of Ghana bills. The way is now open for the monetary authority to pursue monetary policy by managing policy instruments to bring about certain changes in intermediate targets and, consequently, in ultimate targets.

Monetary targets

During the era of the economic reform programme in Ghana the projection of monetary targets, as indicated earlier, was based on an "assumed" velocity that was exogenously determined. With the velocity established, the assets side of the monetary programme was formulated as follows:[1]

$$M2 = NFA + NDA + RVA - SDRA \quad (1)$$

$$NDA = CGT + COC + CRE + ONA \quad (2)$$

Where

M2 = nominal money stock, broad definition

NFA = net foreign assets (nominal terms) defined as the difference between foreign assets (FA) and liabilities (FL), comprising NFA of banking system, net IMF position, post 1972 payment arrears, pre 1972 payment arrears and participation arrears

NDA = net domestic assets defined as the sum of total credits to government, cocoa financing, credit to the rest of economy and net other assets

RVA = revaluation losses/account

SDRA = special drawing rights allocation

CGT = total credit to government (nominal terms) defined as the sum of net claims on government and claims on public entities

COC = cocoa financing (nominal terms)

CRE = credit to the rest of economy (nominal terms)

ONA = other assets (net)

The liabilities aspects were left unprogrammed as illustrated by Ghana's monetary programme in December 1990. (Refer to Table 2). Thus what happened to currency (or M0), demand, saving and time deposits did not matter directly. Besides, the exchange rates were assumed to be constant at ¢303:$1. In the same financial programme there was provision for revaluation loss, but a revaluation loss should be consequent upon exchange rate depreciation. When we removed the NFA-exchange rate inconsistency and used ¢330:$1 which was consistent with the underlying revaluation losses, the NFA targets fell from negative ¢103.1 billion to negative ¢112.3 billion for end-June 1990, from negative ¢101.8 billion to negative ¢110.9 billion for end-September 1990 and from negative ¢90.2 billion to negative ¢98.2 billion for end-December 1990 (Dordunoo, 1990). This implies that for consistency the NDA should be higher than programmed.

The most disturbing issue about the programme was how the GDP target was established. This was most obscure. But it is on the GDP that the velocity was anchored in the programme. The end-December 1991 velocity was programmed to be 7.9 times from a historical velocity of 7.3 times for end-December 1990. The question is: What is the basis of the anticipated acceleration in the transactions velocity when in the same programme inflation was projected to decelerate? We shall visit this again later.

In order to attain the targets (the above as examples), two main instruments were used: reserve requirements and direct quantitative ceilings on domestic credit creation by the banking system. There were modifications during the period, though. The credit policies prior to February 1988 required all banks to channel specific percentages of their total credit to sectors of the economy in line with the development priorities of the government, taking into account the real growth rates projected as well as expected rates of inflation. This policy was changed as banks continued to lend to the commerce sector at the expense of industry and agriculture. Thus, in 1982, the BOG made it mandatory that a minimum of 20% of each bank's credit creation should be allotted to the agricultural sector. By 1988, however, all sectoral lending targets had been removed except for agriculture, which was abolished in 1990 (Sowa, 1991).

Table 2: Ghana monetary programme, 1989–1991[1]

In billion cedis end-period data	Sep-90 Prog	Sep-90 Act	Dec-90 Prog	Mar-91 Prog	Jun-91 Prog	Sep-91 Prog	Dec-91 Prog
Net foreign assets [2]/	-101.8	-64.7	-90.2	-85.7	-78.1	-72.1	-69.0
Bank of Ghana [2]/	-145.8	-111.0	-134.2	-129.7	-122.1	-116.1	-113.0
Deposit money banks [2]/	44.0	46.3	44.0	44.0	44.0	44.0	44.0
Net domestic assets	330.6	318.4	359.1	359.2	360.6	338.9	377.0
Net credit to government	265.1	263.8	257.9	247.9	237.9	232.9	221.0
of which excl rev losses	-8.4	-9.7	-15.7	-25.7	-35.7	-40.7	-52.5
Cocoa board financing (gross)	0.0	0.0	29.7	26.0	15.0	0.0	35.6
Credit to rest of economy	96.4	104.9	109.9	117.1	124.9	133.2	142.2
of which “sound” credit	49.9	58.4	63.4	69.0	75.0	81.6	88.8
Other items, net	-30.9	-50.2	-38.4	-31.8	-17.2	-27.3	-21.9
Revaluation account	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Broad money (M2)	220.4	245.2	260.4	265.0	274.0	258.3	299.4
Narrow money (M1)			185.4				
Currency (M0)							
Demand deposit							
Quasi money			59.9				
Saving deposit							
Time deposit							
SDR allocation	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Nominal GDP			1892.1				2361.4
Velocity of circulation							
GDP/end-period (M2)			7.3				7.9

Source: IMF and Bank of Ghana.

[1] Based on the new NFA of the Bank of Ghana and GCB, and including the discount house since 1 Jan 1989. This is only part of the financial programme. The full survey starts from Dec 89.

[2] Data on the NFA during 1990 and beyond are based on end 1989 exchange rates.

Credit ceilings

Since late 1990 there has been a shift to domestic credit limit in line with real GDP growth rates and inflation targets stipulated in the monetary survey. This mode of global targeting on the net domestic assets of the banking system was accomplished by bank-specific credit ceilings based on five main considerations: deposit mobilization, actual use of bank deposits, recovery rate of new loans created, across the board credit allocation

and, finally, a safety valve consideration.[2] The first credit ceiling criterion was based on deposit liabilities mobilized by the bank in question; in this case 50% of the ceiling was based on deposits mobilized by the bank. The second criterion considers how active a bank was; thus 20% of the bank-specific credit was based on actual use of the bank deposits.

Third, the recovery rate of loans influenced the credit ceiling; 20% of the ceiling was based on the amount of new loans recovered in each quarter. The fourth criterion enjoined the BOG to give 10% (of the global credit to be created) across the board irrespective of the size of the DMBs. The last consideration designated as *safety valve* may be about 20% of the total domestic credit to be created; this percentage was taken from the global credit prior to the distribution along the criteria listed above. Of course, there were other considerations, such as the performance of the net foreign assets (NFA), which also affects the liquidity position of the economy. Similarly, credit for cocoa financing also exerted its own influence in determining the level of credit that could be created in the rest of the economy. In summary, the ceilings that were specified in the form of bank-specific ceilings on credit and other assets of the banking system initially also specified sectoral credit ceilings. The sectoral credit ceilings were removed later. Apart from these instruments, discount rates on treasury bills, as well as deposit and lending rates, were administratively determined by the Bank of Ghana. In addition to the removal of the sectoral credit ceilings, a weekly auction for treasury bills was introduced in order to determine the discount rate. This mode of monetary management, particularly the credit ceiling, led to unfortunate developments in the economy that we now consider.

Credit ceilings could achieve the desirable objective of stabilization if adopted for a short period of time. Besides, it may be conceded that the use of credit ceilings to achieve monetary targets was due to the ease with which they could be administered and their effectiveness in controlling domestic credit. However, because the ceilings were imposed for a long period of time, they created serious distortions. First, they made redundant the use of reserve ratio as an instrument of monetary and credit management, leading to excess reserve holdings. Second, lending interest rates of commercial banks were increased and deposit rates were kept low, resulting in a widening of the spread. Third, they led to an increase in currency with the non-bank public and discouraged deposit mobilization. Fourth, they reduced the M2-GDP ratio or the degree of financial intermediation. Additionally, credit ceilings discourage competition among banks since the banks have little or no incentive to compete for new deposits if they are up against their ceiling. Further, they have strong incentives to compete for favours (in the form of higher ceilings) from the monetary authorities. We now take these in turn.[3]

Excess reserves coexisting with excess demand for credit

Because of the draconian credit ceilings the banks were unable to lend all the resources mobilized. (Nor could the resources be invested in other lucrative investment opportunities.) The most important development that led to extra excess reserves was the drastic retirement of government domestic debt and the sharp fall in the government's reliance on the banking system to finance budget deficits. As can be seen in Table 3, the actual and the required cash and secondary ratios from 1983 to 1991 revealed positive excess reserves reaching as high as 25% in 1986; thereafter they declined to 7%, only to rise again to 19% in 1991. Surprisingly, the excess reserves in the banking system coexisted with an unsatisfied excess demand for credits by business firms.

The direct impact on the deposit money banks was to dampen their resources mobilization efforts. It has been alleged that some banks were turning away potential savers, a practice that was extremely unhealthy for savings in the economy. This should not be surprising based on the reserves position of the deposit money banks due to the credit ceiling.

In order to mop up the excess liquidity in the banking system, the central bank introduced Bank of Ghana bills. Despite the fact that the open market sales of the financial papers affected the monetary base and also caused changes in the monetary multiplier, they have not reduced the excess reserves of the banks. It is important to note that the yields on the instruments were so high that the willingness of the banks to hold them increased drastically to the detriment of credit to the private sector, thereby squeezing further the credit requirements for private sector development.

Widening spread between deposit and lending rates

Because of the credit constraint on the DMBs, banks had loaded their lending rates to cover operational costs and maintain profitability, thereby increasing the effective cost of credit. The higher lending rates vis-a-vis low deposit rates drastically discouraged financial intermediation. Additionally, the DMBs revealed stronger preference for demand deposits as against saving and time deposits. Thus while time deposits amounted to about ¢16.3 billion by end December 1988, by March 1990 this had fallen to less than ¢9.91 billion. For the same period, despite the fact that lending rates had been around 34.4%, time deposit rates ranged between 9.0% and 15.0%. There was evidence adduced to the fact that some banks were paying as low as 6.0% per annum. All this vividly illustrates the lack of competition among the DMBs due mainly to the credit ceilings imposed. With reserve requirements as high as 57%, the wide spreads also resulted in an indirect control system and therefore impair the credit creation potential of the deposit money banks.

Table 3: Required, actual and excess reserve holdings, 1983–1991

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991
Cash ratio (%)									
Required	24	10	13	8	22	20	22	22	22
Actual	29	26	25	25	25	23	28	30	28
Excess	5	16	11	17	4	3	6	8	6
Secondary ratio (%)									
Required	28	35	27	15	7	10	15	20	20
Actual	44	32	27	22	15	17	16	29	34
Excess	16	-3	0	7	8	7	1	9	14
Totals (%)									
Required	52	45	40	23	28	30	37	42	42
Actual	73	58	51	48	40	40	45	59	61
Excess	21	13	11	25	12	10	7	17	19
Secondary reserves			8400	11733	12016	17457	23817	55738	71560
Bank of Ghana bills								26461	45231
Cocoa bills					0	4319	293	13178	10947
Treasury bills			1987	2731	3355	1700	538	0	0
Government stocks			6126	8195	7117	6457	5819	2948	2893
Subtotal			8113	10926	10476	12476	6650	42587	59071

Source: Bank of Ghana.

High proportion of currency with non-bank public

The lack of active mobilization of resources by the DMBs, coupled with very low deposit rates, resulted in the build up of liquidity outside the banks. This was reflected in a high proportion of currency with the non-bank public, i.e., M0, which remained above 50% of M1. (Refer to Table 4).

The immediate impact of an increase in currency with the non-bank public (M0) was a corresponding increased demand for goods and services, which in turn exerted inflationary pressures as well as increased depreciation of the cedi in the foreign exchange market. The rapid depreciation of the cedi emanates from two demand pressures consequent upon increased liquidity outside the banks: demand for foreign exchange as a hedge against the continuing depreciation of the cedi and demand for the import of goods. All this in turn jointly exerts pressures on the exchange rates and the current account balance, which had remained negative over the ERP era.

An important irony emerges: we imposed credit ceilings to reduce inflationary pressures, but in the process, we have increased liquidity outside the banking system, which in turn exerted the inflationary pressures we sought to prevent. We need a new and better financial management framework.

Table 4: Money supply (M1) and its components (million cedis)

End of period	Currency with non-bank public (1)	Demand deposits with banks (2)	Money supply 3 = 1 + 2
1983	10033.9	6377.1	16411.0
1984	12422.3	14947.7	27370.0
1985	17241.2	26708.8	43950.0
1986	31240.2	34575.5	65815.7
1987	46116.5	48925.5	95042.0
1988	65036.9	73944.1	139031.0
1989	82916.7	102236.4	185153.1
1990	80044.7	136913.4	216958.1
1991	90030.1	139160.0	229190.1

Sources Quarte rly Economic Bulletin, Bank of Ghana.
Ghana: Progress on Adjustment, World Bank.

The follow-up effect of inability of the MDBs to mobilize deposits further not only results in a shift out of deposits to cash but also reduces the overall supply of money leading to financial squeeze. This may reduce inflation in the short run. In the medium term, however, the financial squeeze leads to contraction of economic activity.

Declining financial intermediation (M2-GDP ratio)

It is pertinent to note that policies of an excessively tight monetary control and credit squeeze adopted during the era of the ERP led to a steady reduction in broad money or M2-GDP ratio, from over 18% in 1986 to as low as 13% in 1991, reflecting an extremely weak degree of financial intermediation and its adverse effect on productive economic activities. Ghana's M2-GDP ratio was more than 29% in 1976, but declined rapidly in the wake of the ERP, all in a bid for demand management and exchange rate stability. During the ERP era it has been domestic credit, especially credit to the rest of the economy (and particularly the industrial sector), that suffered most.

Comparable figures for 1961–1991 of selected countries that have registered rapid development in recent times are reported in Table 5. It is important to note that inflation decelerated with a reduction in money supply but not as fast as desirable; nevertheless, growth hardly exceeded 5% per annum. On the other hand, the countries mentioned in Table 5 recorded faster deceleration in inflation hand in hand with a growth rate above 8% to 10% per annum, while their M2-GDP ratios are all far higher than Ghana's. The estimate for Thailand was 78.4% for 1991 from 75% in 1990. This seems to suggest that as the degree of intermediation rises, the rate of inflation tends to decelerate.

Table 5: Financial intermediation of selected countries
(measured by M2-GDP ratio, percentages)

Country\Year	1961	1976	1990	1991
Ghana	19.0	29.2	15.0	13.3
Indonesia	9.0*	17.1	35.0*	39.1+
Korea	14.0	30.0	40.0	45.8+
Malaysia	26.0	45.5	68.0	72.3+
Thailand	24.0	36.3	75.0	78.4+

Sources: World Bank (1992), IFS 1991 Yearbook and Ministry of Finance and Economic Planning
*Indonesia data are for 1969 and 1989.
+Provisional estimates.

IV. A proposed monetary targeting framework

Any realistic monetary programme must address both the demand for and the supply of money.[4] The sources of money supply must be clearly identified. The four main sources of broad monetary stock (M2) are net foreign assets (NFA), net domestic assets (NDA), revaluation account (RVA) less special drawing rights allocation (SDRA) as stated in Equation 1. In Equation 2 net domestic assets is defined as the sum of total credit to government (CGT), cocoa financing (COC), and credit to the rest of the economy (CRE) plus or minus other net assets (ONA).

.For ease of reference, we reproduce equations 1 and 2 from the previous section as follows:

$$M2 = NFA + NDA + RVA - SDRA \quad (1)$$

$$NDA = CGT + COC + CRE + ONA \quad (2)$$

From Equation 2, the NDA of the economy has three main elements. This definition can be redecomposed into two major parts: the NDA of the Bank of Ghana and that of the commercial banks or the deposit money banks (DMBs). That is:

$$NDA = NDA_{BOG} + NDA_{DMB} \quad (3)$$

It is vital to note that the net domestic assets of the Bank of Ghana and those of the DMBs are closely related. This means that an active indirect management of the NDA_{BOG} through open market operations will largely influence the NDA_{DMB}. In order to establish the strong linkage between the two domestic assets we expose the composition of the *NDA* of *BOG* and the *NDA* of the *DMBs.*

Following Equation 2, the net domestic assets of the central bank may be defined as follows:

$$NDA_{BOG} = NCDMB_{BOG} + NCG_{BOG} + COC_{BOG} + CRE_{BOG} + ONA_{BOG} \quad (4)$$

Where

NDA_{BOG} = net domestic assets of the Bank of Ghana

$NCDMB_{BOG}$ = net claims by the deposit money banks on Bank of Ghana

NCG_{BOG} = net credit to government by BOG

COC_{BOG} = cocoa financing by Bank of Ghana

CRE_{BOG} = Bank of Ghana's claims on the rest of the economy

ONA_{BOG} = other items (net) claims on BOG

Similarly, the net domestic assets of the deposit money banks (NDA_{DMB}) may be defined as follows:

$$NDA_{DMB} = NCG_{DMB} + CRE_{DMB} + ONA_{DMB} \quad (5)$$

Where

NDA_{DMB} = net domestic assets of the DMBs

NCG_{DMB} = net credit to government by DMBs

CRE_{DMB} = credit to the rest of the economy by DMBs

ONA_{DMB} = other items (net) claims on DMBs

From the perspective of deposit liabilities of commercial banks it is instructive to note that the *NDA* of the DMBs is the difference between their total deposit liabilities (DL_{DMB}) on the one hand and the sum of net credit by the *BOG* ($NCDMB_{BOG}$) and the net foreign assets of the *DMBs* (NFA_{DMB}), i.e:

$$NDA_{DMB} = DL_{DMB} - (NCDMB_{BOG} + NFA_{DMB}) \quad (6)$$

Thus in equilibrium, in view of equations 5 and 6, we have:

$$NCG_{DMB} + CRE_{DMB} + ONA_{DMB} = DL_{DMB} - (NCDMB_{BOG} + NFA_{DMB}) \quad (6.1)$$

It is important to note that the total deposit liabilities comprise demand (DD), saving (DS) and time deposits (DT), i.e.,

$$DL_{DMB} = DD + DS + DT \quad (6.2)$$

The definitions in Equations 4 and 6 imply that the net claims of the DMBs on the BOG, a component of the NDA_{BOG}, is a component of NDA_{DMB}. Therefore, a change in the NDA_{BOG} due to a change in $NCDMB_{BOG}$ will definitely influence the NDA_{DMB}. Also, changes in the components of DL_{DMB} are influenced mainly by deposit interest rates even though the final decision taker is the private individual. Thus changes in all these variables — deposit liabilities and the net claims of *DMBs* – are crucial to the monetary authority.

We are, therefore, keenly interested in the components of the net claims of DMBs on the BOG. These include cash reserves, secondary reserves and holdings of BOG

instruments:

$$NCDMB_{BOG} = CASHR + SRES + INST_{BOG} \quad (7)$$

$$= r_c.DL_{DMB} + r_s.DL_{DMB} + INST_{BOG}$$

Where

CASHR = cash reserves

SRES = secondary reserves

$INST_{BOG}$ = instruments of Bank of Ghana

r_c = cash reserve ratio

r_s = secondary reserve ratio

In view of Equation 7, it is possible for the central bank to influence the level of NDA_{DMB} by controlling one or all of the three components, cash reserve ratio, secondary reserve ratio and the yield rate on the BOG instruments, which in turn will influence decisions by DMBs to buy and/or sell BOG instruments. The purchase and/or sale of instruments to commercial banks (and the public at large) is to achieve the desired target of claims of commercial banks consistent with the NDA target. Instruments should be sold in order to reduce liquidity if NDA exceeds the target; instruments should be bought back in order to inject liquidity into the system if NDA is below target. Supposing that the portfolio preferences of DMBs are such that they are unwilling to buy instruments floated by the BOG; then the central bank may use moral suasion (arm twisting) or *vary the reserve requirements* by changing the cash and secondary reserve ratios to achieve its monetary policy objectives.

V. Implementation and proposed methodology

Establishing the monetary targets

In the previous section we proposed the theoretical basis of a monetary targeting framework. The implementation of such a scheme requires establishing how much money should grow to be consistent with the absorptive capacity of the economy to ensure growth and development. This will be accomplished using a money demand function. Thus the first stage is to estimate a money demand function and derive the absorptive capacity of the economy. This is addressed in Section VI.

The second stage requires the targeting of the main components of money supply from both the assets side (such as reported in the analytical frame) and the liabilities side (i.e., demand, time and saving deposits, and currency with the non-bank public) that must be consistent with the demand for money, bearing in mind the projected growth in real GDP and price inflation rates, among other important factors that affect these variables. The behavioural functions of all the components must be specified and estimated and then used to forecast their targets. Third, after forecasting all the components of the assets side and all the components of the liabilities side (particularly the deposit liabilities of the DMBs), we should establish the targets that must be attained in the following year. All the targets are then reconciled with the money demand determined targets. This is addressed in Section VII.

Fourth, the monthly and quarterly frequencies are then isolated for close monitoring using the behavioural pattern of the economy such as time for cocoa purchases, retirement of domestic debt by government, "sound" and "non-performing" credits to the rest of the economy, time of receipts from exports and payment for imports, etc. Other important influences that must be brought to inform the programming include a thorough understanding of the money market and the lag structure of the response of instruments to policy announcement and enactment.

Achieving the targets

After having established the appropriate frequencies and the corresponding targets, the monitoring of the whole economy and the supervision of the banking system become paramount. The most important indicator is price development. Also important are such leading indicators (used in establishing the targets) as the time for increase in liquidity due to cocoa purchases, business and commercial consumption of electricity and petrol/

gas, the sale of minerals (such as gold and diamond) and timber, etc. On the fiscal side, major revenue items and expenditure items should also be monitored.

The returns by all DMBs and consolidated discount houses (CDHs) must be submitted to the OMO committee to ensure evaluation of developments against targets and in order to reduce policy execution lags that may occur. Besides, efforts must be afoot to identify the factors responsible for the monetary aggregates getting "off track", as well as the time lag between the changes in the instruments and the intermediate variables that have to be changed. The BOG must be free to review and/or change monetary policy as and when it becomes necessary, taking into consideration the crucial lags.

The four major lags to be carefully identified and used in achieving policy objectives are:

- ***Policy (need-effect) time lag*** - the interval of time between a need for a counter-cyclical policy action and the actual effect of that policy action on an economic variable.
- ***Recognition lag*** -the interval between the time that the need for a counter-cyclical action arises and the time this need is recognized by a policy maker. This applies, for example, to a price increase that may be recognized only when the PCPI data have been compiled, which takes weeks or even months to become available.
- ***Implementation/response lag*** - the time between recognition of a need for a counter-cyclical action and actual implementation of the policy action. For example, the OMO committee may have to engage in a discussion of the policy decision on the reserve ratios with the DMBs and the fiscal authorities.
- ***Transmission lag*** - the time that elapses between implementation of an intended counter-cyclical policy and its ultimate effects on an economic variable.

Data requirements and method of analysis

The main objective of this study is to develop a computer-based monetary management framework using annual (which could be decomposed into quarterly and/or monthly) data. The behavioural equations are developed and simultaneously estimated using *MICROFIT* (Pesaran and Pesaran, 1995) and *Micro TSP* (Lilien, 1996).

The main sources of the basic data series (not necessarily the data transformations) are the various issues of the *Quarterly Digest of Statistics* (QDS) of the Ghana Statistical Service in *Ghana: Progress on Adjustment*, April 1991, of the World Bank; and the *International Financial Statistics* (IFS) of the International Monetary Fund (IMF). It is crucial to note that almost all the data series have been drastically revised by the Ghana Statistical Service in the QDS Vol. XI No. 2 of June 1993 as well as their preliminary estimates of the 1992 statistics. The time series data used in the estimation of the model were based on the official position. We did not incorporate the updated series because from June 1994 and beyond they are only preliminary estimates. In the case of the IFS we used the data as contained in the 1988 to 1994 Yearbooks. The data used for estimating the model can be obtained upon request from the authors.

VI. Establishing the monetary target: money demand

A theoretical framework

The first stage of our proposed framework is the estimation of the money demand function. In order to evaluate which function will perform best in predicting the desirable monetary stock in the economy we will experiment with money demand functions for both structural stability and predictability. The equations are:

$M2D = M(Y, R, DP^e, ..); M_1 \geq 0, M_2, M_3 \leq 0$

$M1D = M(Y, R, DP^e, ..); M_1 \geq 0, M_2, F_3 \leq 0$

Where

M2D = M2 = money demand, broad definition, (real terms, 1975 prices)

M1D = M1 = money demand, narrow definition (real terms, 1975 prices)

Y = real gross domestic product (1975 prices)

R = vector of interest rates to be experimented with

DR = interest rate (bank rate); RD = deposit interest rate

RL = lending interest rate

DP^e = DPGDP = expected inflation rate captured by a change in GDP price deflator (1975 = 100), or a change in PCPI = consumer price index (1975 = 100)

The equations (D1) and (D1[1]) are specifications of money demand functions for broad and narrow definitions, respectively. Each of them shows positive dependence on income (as "scale" variable) for transactions balances and negative dependence on expected inflation and interest rate (an "opportunity cost" variable) for speculative balances. Both the "scale" and "opportunity cost" variables are pertinent macroeconomic variables that are relevant for decision making by demanders of money. In this respect, while the scale variable relates the money stock to the transactions to be financed, the opportunity cost

variable relates the holdings of money to the attractiveness of other assets such as Bank of Ghana bonds, Government of Ghana treasury bills, cocoa bills, revaluation loss consoles, non-performing assets recovery trust (NPART) bonds, and shares and stocks on the Ghana Stock Exchange Market (GSEM).

Other variables we shall experiment with include GNP as against GDP; the real exchange rate will be introduced as an argument to capture currency substitution. We shall also experiment with nominal and real interest rates and the logarithmic transformation of one plus interest rate (i.e., 1 + r). Apart from using the inflation rate as an argument we intend to normalize the rate of inflation by obtaining [inflation/ (1+inflation)].

In the money demand function we have to deflate the nominal money stock with the general price level. A relevant theoretical and practical issue of concern is the choice of the appropriate measure of price level to be used as a deflator for the nominal cash balances. In the case of real demand for money the appropriate deflator is the PGDP. However, given that inflation is a measure of opportunity cost for holding money, then the relevant price level variable should be the consumer price index (PCPI) or the wholesale price index (PWPI). We will experiment with all these price variables in the estimation of our behaviourial relations.

A logarithmic form of a money demand function that is appropriate for the derivation of the absorptive capacity of the economy is as follows:

$$LnM2 = C_o + C_1\, LnY - C_2\, Dlnp + C_3\, LnM2_{-1} \qquad (D2)$$

$$LnM1 = C_o + C_1\, LnY - C_2\, Dlnp + C_3\, LnM1_{-1} \qquad (D2^1)$$

Where

LnM2 = natural log of broad money (M2)

Ci = ith parameter to be estimated

LnY = natural log of real GDP

Dlnp = first difference of the natural log of price level (or inflation rate)

The guiding rule is that the quantum increase in money stock consistent with the absorptive capacity of the economy should be equal to the *product of income elasticity and growth rate in nominal GDP less the product of the price elasticity and price inflation plus a small amount of inflation conducive for good business.* Symbolically, this monetary rule is:

$$m2z_{t+1} = C_1 * yz_{t+1} - C_2 * p_{t+1} + SM_{t+1} \qquad (D2^*)$$

$$m1z_{t+1} = C_1 * yz_{t+1} - C_2 * p_{t+1} + SM_{t+1} \qquad (D3^*)$$

Where

miz	=	projected growth rate of nominal money (i = 1, 2)
yz	=	growth rate of nominal GDP
p_{t+1}	=	projected (price) inflation rate
C_1	=	income elasticity of real money demand
C_2	=	inflation price elasticity of real money demand
SM	=	small amount of projected inflation rate conducive for good business

The monetary rule in equations ($D2^{*}$) and ($D2^{*1}$) will settle a basic bone of contention in monetary management approaches between the Bank of Ghana (BOG) and the IMF. While the BOG will advocate for targeting narrow monetary growth, IMF will rather prefer targeting broad monetary growth. Additionally, this monetary rule will provide a check on the internal consistency of projections on the narrow money growth captured by the real money demand equation and the projections from real quasi money based on the quasi-money equation. In principle the level of broad real money balances must equal the narrow money balances plus real quasi money. In the equations above prices and GDP may be exogenous or endogenous. We will determine them from the government policy framework paper, which normally states the macroeconomic targets the government wishes to achieve in the ensuing year. Or, we may determine them using a production function and price function, respectively, in a macroeconometric model of Ghana (Dordunoo, 1995b, 1994b).

Empirical results

We have reported four equations. The best result of money demand function estimated for the period 1970 – 1992 is Equation $ED1^{b}$ reported in Table 6, after which we derive the growth target that will be consistent with the inflation rate and the real GDP growth rate. We, however, reported the results of both equations $ED1^{a}$ and $ED1^{b}$. The t's are in brackets. In terms of the performance of the equations, it seems that targeting M2 will yield fewer forecast errors (as the mean absolute percentage errors are smaller) than those in the M1 equations. The M1 equations are not reported because of the high simulation errors.

The econometric results reveal that real GDP is a better explanatory variable than GNP. A possible explanation is that while non-Ghanaians resident in Ghana demand cedi for transactions, Ghanaians resident abroad do not demand cedi for their transactions in the foreign countries in which they reside. For the exchange rate (ER) argument of currency substitution, the results show that not only is ER preceded by the wrong sign, its t is very low.

Table 6: Money demand regression equations

Money demand equation with a lag Lnm2 (OLS)

ED1[a].	LNM2	=	0.2926 + 0.1444 LNY - 0.4364 DLNCPI - 0.0373 LNDR + 0.8148 $LNM2_1$				
			(0.0714)	(0.2371)	(-1.8740)	(-0.3046)	(3.8964)
	$A\text{-}R^2$	=	0.6890				
	F	=	12.6302				
	DW	=	1.7768				
	MAPE	=	10.6785%				
	TIC	=	3.2678				

Money demand equation with a lag Lnm2 (C-O)

ED1[b].	LNM2	=	-0.3752 + 0.2949 LNY - 0.4261 DLNCPI - 0.0743 LNDR + 0.7385 $LNM2_1$				
			(-0.0776)	(0.3777)	(-1.6382)	(-0.4577)	(2.3055)
	$A\text{-}R^2$	=	0.6755				
	F	=	9.3284				
	DW	=	1.7882				
	MAPE	=	10.3049%				
	TIC	=	3.2101				
	C-O AR(1) CON	=	6 Iterations				

Money demand equation without a lag

ED2.	LNM2	=	-4.5080 + 1.4081 LNY - 0.0838 LNCPI - 0.0491 LNDR			
			(-0.9887)	(2.5795)	(-1.6741	(-0.2529)
	$A\text{-}R^2$	=	0.6443			
	F	=	10.5097			
	DW	=	1.8429			
	MAPE	=	10.3176%			
	TIC	=	3.2121			
	C-O AR(1) CON	=	4 Iterations			

Money demand equation with output and price arguments

ED3.	LNM2	=	-4.2336 + 1.3677 LNY - 0.09260 LNCPI		
			(-0.9912)	(2.7175)	(-2.8131)
	$A\text{-}R^2$	=	0.6628		
	F	=	14.7590		
	DW	=	1.88733		
	MAPE	=	10.3366%		
	TIC	=	3.2151		
	C-O AR(1) CON	=	4 Iterations		

The reason may be that for the period 1970–1992 the greater part of observations (1970–1983) were characterized by fixed exchange rate. We adopted a split regression where the sample period 1983–1992 had been used for the regression, but the model was seriously constrained by a low degree of freedom. As far as the interest rate is concerned the logarithmic transformation of nominal interest rate performed relatively better than the

real interest rate; the log of (1 + r) performed least satisfactorily with wrong sign and low t. The inclusion of the inflation rate as a percentage change of CPI performed relatively better than the transformed version [inflation/(1+inflation)]. The results in which the above arguments reveal perverse results have not been reported.

Equation ED1[b], which uses a Cochrane-Orcutt method and contains lagged real money balances, is selected because it has satisfied all the *a priori* conditions (just as equation ED1[a]).

Even though the income and interest rate arguments are not significant, the overall performance of the equation is fairly strong, with an adjusted R^2 of 0.68, and a mean absolute percentage error (MAPE) of 10.3. Interest rate is not significant because it has been mandatorily fixed over a very long period by the monetary authority. Its exclusion, however, has reduced the predictive power of the equation indicated by a higher MAPE. Equation ED2, which contains the interest rate performed less satisfactorily than equation ED3. However, equation ED3 could not be used as it may have biased upwards the income elasticity due to the omission of the inflation rate. The level of prices that has appeared on the two sides of the equation, denominator on the left and regressor on the right, constitutes a test of the imposition of homogeneity of money demand. Thus, for the purpose of determining the absorptive capacity of the economy we used equation ED1[b]. This equation has been selected because of its fairly high ability to track turning points over the historical period as well as its superior predictive power.

It should be noted that in all the empirical regressions the left-hand side has real money supply, which in equilibrium is equal to the real money demand. Another important point to note is that these regressions may be criticized as revealing spurious correlations of trended variables in view of the large and convincing literature on "spurious" regressions. For practical purposes we use the traditional econometric methods. In a later study we shall use the cointegration technique to establish the extent to which the results would be used for financial programming and the preparations of monetary survey.

Forecasting broad money demand target

Supposing, for purposes of simulation exercise, we adopt an annual real GDP growth rate of 5% and inflation rate of 15% for 1993, an increase in the rate of interest of 1.68%, and an increase in nominal broad money of 31%; then, using an extended version of the relationship in Equation D2[*] the corresponding growth in broadly defined money stock for 1993 should be:

$$\begin{aligned} M2z &= (0.2949)(20) - (0.4261)(15) - (0.0743)(1.68) + (0.7385)(31) \\ &= 28.7915 - 6.5163 \\ &= 22.2752\% \end{aligned}$$

$$\begin{aligned} \Rightarrow M2 &= 22.2752 - 15 \\ &= 7.2752\% \end{aligned}$$

An alternative method of determining the growth rate of broad money is now addressed. For the purpose of comparsion, we may obtain the logarithmic level of M2 (LNM2) by

substituting the log levels of the real income, change in price level (DLNCPI), the log of interest rate (LNDR), and the lagged or predetermined value of real money balances ($LNM2_{-1}$). The anti-log of the RHS gives the level positions. The simulation experiment of equation ED1[b] yields the following results:

$$
\begin{aligned}
LNM2_{93} &= -0.3752 + (0.2949 * 8.9710) - (0.4261 * 0.15) \\
&\quad - (0.0743 * 3.5553) + (0.3752 * 7.1506) \\
&= -0.3752 + 2.6455 - 0.0639 - 0.2642 + 5.2807 \\
&= 7.9262 - 0.7033 \\
&= 7.2229 \\
\Rightarrow \quad M2_{93} &= 1370.4576
\end{aligned}
$$

$$
\begin{aligned}
\text{But} \quad LNM2_{92} &= 7.1506 \\
\Rightarrow \quad M2_{92} &= 1274.8706 \\
\Rightarrow \quad M2 &= (1370.4576/1274.8706) - 1 \\
&= 7.4978\% \\
\Rightarrow \quad M2z &= 7.4978 + 15 \\
&= 22.4978\%
\end{aligned}
$$

The absorptive capacity and the full equation approach yield about the same growth rates in real money balances. We adopt the results of the second method. For a real GDP growth of 5% and an inflation rate of 15%, among other assumptions, real money balances should rise by not more than 7.5%. From our results, for the growth in nominal money to be consistent with the nominal GDP growth of 20% money supply must increase by 22.5% in 1993. Alternatively stated, for a real GDP growth of 5%, real money should *not* increase by more than 7.5% if we are to avoid an acceleration in the rate of inflation. These growth rates must be considered as the upper limits for credit expansion.

VII. Establishing the monetary target: money supply

A theoretical model

In order to present a theoretical model there is need to revisit some of the relationships and identities used in developing the monetary targeting framework in Section IV. The second level of consistency analysis, called intermediate targeting, requires the targeting of the main components of money supply from both the assets and the liabilities sides. The behavioural relations to be estimated and then used to forecast the sources of money, which are in turn reconciled with the demand for money, are given below.

Identities

Sources of money (assets)

We first address the definitions and behaviourial assumptions. The four main sources of broad money stock (from the assets point of view) are net foreign assets, net domestic assets, revaluation account less special drawing rights allocation as stated in Equation S1. In Equation S2, net domestic assets is defined as the sum of total credit to government, cocoa financing, credit to the rest of the economy, plus or minus other net assets.

$$M2Z = NFAZ + NDAZ + RVAZ - SDRAZ \quad \text{(S1)}$$

$$NDAZ = CGTZ + COCZ + CREZ + ONAZ \quad \text{(S2)}$$

Money supply (liabilities)

On the liabilities side, money supply (broadly defined) is the sum of money supply (narrowly defined) and quasi money (sum of savings and time deposits) in Equation S1[1]. In Equation S3 narrow monetary stock is stated as the sum of currency with the non-bank public and demand deposits.[5]

$$M2Z = M1Z + MQUAZ \quad \text{(S3)}$$

$$M1Z = CUZ + DDZ \quad \text{(S1.1)}$$

Behavioral relations

Equations S4 to S11[2] capture the behavioural relations to be estimated. Equation S4 asserts that NFAZ is an increasing function of imports, short-term foreign debt, but a decreasing function of exchange rate and private unrequited transfers. In Equation S5, total credit to government is postulated as a function of total government expenditure (positively), total tax revenue (negatively), and D83TLR (negatively), which is expected to capture the impact of the trade liberalization in Ghana. The D83TLR argument is to reflect the resolute determination of the Government of Ghana to retire its domestic debts owed to the banking and the non-banking systems.

Cocoa financing in Equation S6, as may be expected, depends positively on the volume of cocoa produced and exported, the exchange rate, and DB3TLR. The latter regressor is to capture the rapid increases in the producer price of cocoa offered to farmers to boost their morale. The cocoa farmer received ¢56,000 per ton in 1985, ¢85,000 in 1986, ¢140,000 in 1987, ¢165,000 in 1988 and ¢174,400 in 1989. This reflects the policy of the government to increase production of cocoa and to reward the farmers who had a terms of trade deterioration owing to the fixed exchange regime prior to 1983 (Dordunoo, 1994a).

The credit to the rest of the economy is postulated to be an increasing function of the exchange rate and deposit rate and income (YZ), but depends negatively on discount rate and net foreign assets as captured in Equation S7. The last argument is to capture whether or not NFAZ is crowding out CREZ. The normal response to the NFAZ (which has become the strongest driving force and source behind monetary expansion in Ghana) is a reduction in CREZ. Consequently, credits to manufacturing and agriculture have been declining while credit to the services sector, particularly retail and wholesale trade, has been on the increase. In symbols, equations S4 to S7 are as follows:

$$NFAZ = F(BOPQZ, DBDSZ, ER, UNRTRPZ);\ F_1, F_2 \geq 0, F_3, F_4 \leq 0 \quad \text{(S4)}$$

$$CGTZ = F(GEZ, TZ, D83TLR);\ F_1 \geq 0, F_2, F_3 \leq 0 \quad \text{(S5)}$$

$$COCZ = F(COV, ERZ, D83TL);\ F_i \geq 0,\ i = 1, 2, 3 \quad \text{(S6)}$$

$$CREZ = F(ERZ, YZ, RD, DR, NFAZ);\ F_1, F_2, F_3 \geq 0, F_4, F_5 \leq 0 \quad \text{(S7)}$$

In Equation S8 we have currency with the non-bank public determined by income (positively), discount rate (negatively) and dummy variable (D82PROB) to capture the effect of policies that reduced confidence in the banking system. The latter were the demonetization of ¢50 notes and freezing of bank deposits greater than ¢50,000 pending investigation for tax liability or fraud. Equation S9 makes demand deposit depend positively on income, degree of urbanization (and use of cheques) captured by urban population (POPU) and number of banks (NOB) to capture the effect of monetization, and negatively on D82PROB to capture the impact of the probe of bank customers in

1982 and 1983. Equation S10 postulates that quasi money depends on income, urban population, number of financial institutions and D82PROB with the same signs as in Equation S9. Equation S11 postulates that revaluation losses respond positively to exchange rate.

$$CUZ = F(YZ, DR, D82PROB, DR, RD, RL);\ F_1 \geq 0,\ F_2,\ F_3 \leq 0 \quad \text{(S8)}$$

$$DDZ = D(YZ, POPU, NOB, D8, DR, RD, RL),\ D_1, D_2, D_3 \geq 0, D_4 \leq 0 \quad \text{(S9)}$$

$$MQUAZ = F(YZ, POPU, NOB, D82),\ F_1,\ F_2,\ F_3 \geq 0,\ F_4 \leq 0 \quad \text{(S10)}$$

$$RVAZ = F(ERZ);\ F' \geq 0 \quad \text{(S11)}$$

Transformation/ratios/definitions

In order for the system to execute the necessary transformation prior to the simulation exercise there is need to incorporate all the transformation/definitions and ratios required for the full solution of the model. These are presented as follows:

$$ONAZ = NDAZ - CGTZ - COCZ - CREZ \quad \text{(S12)}$$

$$C2 = CUZ/(DDZ + DTZ + DSZ) \quad \text{(S13)}$$

$$RRZ = MRR * (DDZ + DTZ + DSZ) \quad \text{(S14)}$$

$$REZ = (1\text{-}MRR) * (DDZ + DTZ + DSZ) \quad \text{(S15)}$$

$$CGTZ = NCGZ + CPEZ \quad \text{(S16)}$$

$$CREZ = CNBFZ + CPSZ \quad \text{(S17)}$$

$$NFAZ = FAZ - FLZ = BSZ + NIMFZ + PO72PAZ + PR72PAZ + PAZ \quad \text{(S18)}$$

$$MQUAZ = DSZ + DTZ \quad \text{(S19)}$$

Equilibrium condition

The model closes with an equilibrium condition that requires the total money supplied to be equal to total money demanded as in Equation S20.

$$M2ZS = M2ZD = M2Z \quad \text{(S20)}$$

Variables in monetary/financial sector

Endogenous variables

M2Z	=	nominal money stock, broad definition
NDAZ	=	net domestic assets defined as the sum of total credits to government, cocoa financing, credit to the rest of economy and net other assets
M1Z	=	nominal money stock, narrow definition
NFAZ	=	net foreign assets (nominal terms) defined as the difference between foreign assets (FAZ) and liabilities (FLZ), comprising NFAZ of banking system, net IMF position, post-1972 payment arrears, pre-1972 payment arrears and participation arrears
CGTZ	=	total credit to government (nominal terms) defined as the sum of net claims on government and claims on public entities
COCZ	=	cocoa financing (nominal terms)
CREZ	=	credit to the rest of economy (nominal terms)
CUZ	=	currency with non-bank public (nominal terms)
DDZ	=	demand deposits (nominal terms)
MQUAZ	=	quasi money comprising savings and time deposits
V2	=	monetary velocity, broad definition

Predetermined variables

RRZ	=	reserve requirements (nominal terms)
REZ	=	excess reserve (nominal terms)
DTSZ	=	total deposits comprising demand, savings and time deposits (nominal terms)

DTZ	=	time deposits (nominal)
DSZ	=	savings deposits (nominal)
YZ	=	nominal gross domestic product
Y	=	real gross domestic product (1975 prices)
DR	=	discount rate (bank rate)
RD	=	deposit rate
RL	=	lending rate
D82PROB	=	D82 = dummy variable to capture ¢50 notes withdrawal policy and freezing of bank customers' accounts of more than ¢50,000 pending investigation for tax liability or fraud in 1982 and 1983
	=	1 for 1982 and 1983 (or alternatively = 0 for 82 and 83)
	=	0 other years (or alternatively = 1 other years)
POPU	=	urban population to capture the degree of urbanization (and use of cheques in transactions)
NOB	=	number of money deposit banks (DMBs)
BOPQZ	=	imports expenditure (nominal terms), balance of payments component
DBDZ	=	total foreign debt (nominal terms)
DBDLZ	=	long-term foreign debt (nominal terms)
DBDMZ	=	medium-term foreign debt (nominal terms)
DBDSZ	=	short-term foreign debt (nominal terms)
GEZ	=	government expenditure (public finance component) (nominal terms)
TZ	=	total tax revenue (nominal terms)
UNRTRPZ	=	private unrequited transfers (nominal terms)

UNRTROZ	=	official unrequited transfers (nominal terms)
D83TLR	=	D83TL = dummy variable to capture trade liberalization policy since 1983
	=	0 for 1970–1982 (no trade liberalization)
	=	1 for 1983–1988 (trade liberalization) (d83tlr is reversed d83tl)
P^e	=	PGDP = expected price level captured by GDP price deflator (1975 = 100)
PCPI	=	consumer price index (1975 = 100)
C2	=	currency total deposit ratio
R2	=	required reserve total deposit ratio
R1	=	required reserve demand deposit ratio
E2	=	excess reserve total deposit ratio
E1	=	excess reserve demand deposit ratio
NCGZ	=	net credit to government (nominal terms)
CPEZ	=	credit to public entities (nominal terms)
FAZ	=	foreign assets (nominal terms)
FLZ	=	foreign liabilities (nominal terms)
BSZ	=	BSNFAZ = banking system NFAZ
NIMFZ	=	net International Monetary Fund (IMF) position
PO72PAZ	=	post 1972 payment arrears
PR72PAZ	=	pre 1972 payment arrears
PAZ	=	participating arrears
ERAZ	=	average exchange rate (: $ ratio)

ERZ	=	exchange rate, end of year (: $ ratio)
COV	=	volume of cocoa purchased and exported
PCOZ	=	price of cocoa (nominal terms)
RVAZ	=	revaluation account to capture exchange losses due to the depreciation of the Ghanaian cedi since 1983
SDRAZ	=	special drawing rights allocation (nominal terms)
MRR	=	minimum required reserve ratio
ARR	=	actual returned reserve ratio
WZ	=	WMINMTZ = wage rate (nominal terms)
PX	=	price of exports (index, 1975 = 100)
PQ	=	price of imports (index, 1975 = 100)
PTOT	=	price terms of trade (PX:PQ ratio)
BTOT	=	barter terms of trade (XINDEX:QINDEX ratio)
XINDEX	=	exports volume (index, 1975 = 100)
QINDEX	=	imports volume (index, 1975 = 100)
RCOTOTD	=	real cost of terms of trade deterioration
CUM2R	=	currency-money ratio (broad definition)

Empirical results

Table 7 presents the empirical results; this is followed by empirical determination of the supply targets. Only the best equations based on the basic test statistics as well as the mean absolute percentage error are reported.

Table 7: Regression results of money supply components

Behavioural relations

Net foreign assets equation

ES4. NFAZ = 6408.5 - 1483.7 ERA + 0.7485 $CGTZ_{-1}$ - 18.4959 DBDSZ - 3.9066 BOPTBZC
(2.7983)(-14.7741) (2.5389) (-3.0151) (-10.0840)

A-R^2	=	0.9925
F	=	565.3495
DW	=	2.6908
MAPE	=	9.1732%
TIC	=	3.0287

Total claims on government equation

ES5. CGTZ = 12028.4 + 2.2748 GEZ_{-1} - 2.4417 TZ_{-1} - 11267.9 D83TLR
(7.3229)(11.6358) (11.5439) (-7.6665)

A-R^2	=	0.9718
F	=	138.8087
DW	=	2.2283
MAPE	=	10.7865%
TIC	=	3.2843

C-O AR(1) CON = 3 iterations

Cocoa financing function

ES6. COCZ = 444.2228 + 16.5354 ERA + 0.5923 $COCZ_{-1}$ + 5928.2 D83TL
(0.4311) (0.1363) (0.4391) (2.4964)

A-R^2	=	0.8927
F	=	34.2804
DW	=	2.1885
MAPE	=	28.5505%
TIC	=	5.3433

C-O AR(1) CON = 3 iterations

Credit to rest of economy equation

ES7. CREZ = 1165.5 + 0.0437 YZ - 0.1226 NFAZ - 1714.9 DR + 1757.9 RD
(1.2856) (8.7985) (-4.8733) (-4.0122) (3.7952)

A-R^2	=	0.9954
F	=	731.8102
DW	=	2.1815
MAPE	=	7.2053%
TIC	=	2.6843

C-O AR(1) CON = 4 iterations

Currency (with non-bank public) function

ES8. CUZ = 2736.0 + 0.0206 YZ + 2763.2 D82PROB + 3.4702 P_{-1}
(-2.765) (1.6685) (2.6269) (3.4065)

A-R^2	=	0.9947

F = 1063.9
DW = 2.0745
MAPE = 5.5829%
TIC = 2.3628

Demand deposit function

ES9. DDZ = 33455.8 + 0.0805 YZ - 7.3291 POPU - 52.5526 NOB - 2504.2 D82PROB + 84.2332 RD
(1.6927) (13.8168) (-1.3126) (-0.9542) (-1.4247) (0.5550)
A-R^2 = 0.9948
F = 547.1428
DW = 1.2278
MAPE = 7.6283%
TIC = 2.7619
C-O AR(1) CON = 7 iterations

Quasi-Money (savings and time deposits) equation

ES10. MQUAZ = -46.2530 + 0.1158 YZ - 5.7208 $PGDP_{-1}$ - 3421.3 D82
(-0.1204)(7.6091) (-4.6034) (-3.1437)
A-R^2 = 0.9833
F = 236.7812
DW = 2.5286
MAPE = 11.9731%
TIC = 3.4602
C-O AR(1) CON = 6 iterations

Revaluation losses equation

ES11. RVAZ = -5471.3 + 1051.5 ERZ
(-0.1612) (4.0269)
A-R^2 = 0.8220
F = 10.2351
DW = 2.0461
MAPE = 10.0081%
TIC = 3.1636
C-O AR(1) CON = 3 iterations

Establishing the annual monetary targets

The broad money stock at the end of 1992 is ¢519.34 billion. (See Table 8.) Since the nominal GDP for 1992 is ¢3008.78 billion, the transactions velocity is 5.79 times at the end of December 1992. Based on the format above, the projected stock of money for the end of 1993 is ¢636.18 billion, while nominal GDP is projected to be ¢3,745.93 billion, bringing the transactions velocity to 5.89 times, indicating a slight increase in financial intermediation from 17.27% to 16.98%.

Table 8: Monetary programme, 1991–1993

In billion cedis end-period data	Dec-91 Act	Dec-92 Act	Dec-93 Proj	Equation Utilized
Net foreign assets	-97.52	-98.47	-90.24	ES4
Bank of Ghana	-141.52	-142.47	-134.24	Derived
Deposit money banks	44.00	44.00	44.00	Exogenous
Net domestic assets	408.40	602.91	711.55	ES2
Net credit to government	294.63	397.11	476.53	ES5
of which excl rev losses	-73.81	-86.54	-92.54	ES11
Cocoa board financing (gross)	36.88	56.70	87.89	ES6
Credit to rest of economy	102.90	128.85	163.69	ES7
of which "sound" credit	99.00	100.00	143.69	Exogenous
Other items, net	-26.01	20.25	-16.56	Residual
Revaluation account	26.00	26.00	26.00	Exogenous
Broad money (M2Z)	325.78	519.34	636.18	ED1[b]
Narrow money (M1Z)	229.19	360.69	432.83	S3/Derived
Currency (M0Z)	90.03	183.48	220.01	ES8
Demand deposit	139.16	177.21	210.82	ES9
Quasi money	96.53	158.66	203.35	ES10
Saving deposit	79.01	116.39	134.51	Ratio/Decomposition
Time deposit	17.58	42.27	68.84	Ratio/Decomposition
SDR allocation	11.13	11.13	11.13	Exogenous
Nominal GDP	2574.77	3008.78	3745.93	Macro Model
Velocity of circulation GDP/end-period M2	7.90	5.79	5.89	Ratio

Source of history: IMF and Bank of Ghana.
1991 and 1992 are actuals and are subject to revision by the Bank of Ghana.
The 1993 figures are projections using our model; they are for illustration only and may not be the same as the preliminary actuals.

The next question to answer is: What are the sources of money supply and how much should each component rise to be consistent with an end-of-year annual stock of ₵654.13 billion derived from the money demand function? Table 8 presents the annual financial programme using the empirical money supply model. The targets are obtained by purely conditional mechanical forecasts. Thus they are subject to the path traced by the rate of inflation, interest rate assumptions, balance of payments, public finance especially credit to government, exchange rate, income assumptions, etc.

Sequence analysis of determining projections in Table 8

The targets established in Table 8 are obtained using a computerized version of our financial model based on TSP Version 8.0. The simultaneous nature of the simulation and model solution exercise compels us to use TSP, which is capable of handling a system of over 700 parameters. It is possible to use the basic model for forecasting provided all the pre-determined and exogenous variables are loaded with all the identities and transformation equations. The aim of this subsection is to explain the mechanical sequence of how the financial programming model works in establishing the targets.

Broad money demand (M2Z)

The first stage of establishing the monetary targets begins with the determination of the demand for money. The money demand function in Equation ED1[b] is used to obtain the nominal broad money as illustrated above. With the nominal money growth rate, m2z, of 22.4978%, and a level of ¢519.34 billion in 1992, the nominal broad money for 1993 is derived as follows:

$$\begin{aligned} M2Z_{93} &= (1 + m2z)(M2Z_{92}) \\ &= (1.224978)(519.34) \\ &= 636.18 \end{aligned}$$

Components of broad money supply (assets side)

The second major stage in the determination of the monetary programme addresses the components of sources of money supply. The net foreign assets (NFAZ) is obtained from the behavioural equation ES4. The projection of the component for DMBs ($NFAZ_{DMB}$) is exogenously determined. With the two variables known, the net assets accruing to the Bank of Ghana ($NFAZ_{BOG}$) are then derived.

The net domestic assets (NDAZ) starts with the determination of net credit to government (CTGZ) and revaluation losses (RVAZ), cocoa financing (COCZ) and credit to the rest of the economy (CREZ), using equations ES5, ES11, ES6 and ES7, respectively. The residual (ONAZ) is needed to compute the total NDAZ. In order to obtain this residual we use equation S1 to obtain the result less the residual that must be equal to the value forecasted from ED1[b]. The SDR allocation, which is exogenous, must be included on the assets side. The difference between M2Z from S1 and ED1[b] should be equal to ONAZ given an exogenous revaluation account. It is to be noted that CGTZ includes the revaluation losses other than the one in the constant revaluation account.

Components of broad money supply (liabilities side)

The third major stage in the sequence involves the determination of the liabilities of the monetary authorities. It begins with establishing the targets for currency with the non-bank public (M0Z) and demand deposit (DDZ) using equations ES8 and ES9, respectively. Narrow money (M1Z) liabilities are then derived using Equation S3. Equation ES10 is used to obtain the value for quasi money (MQUAZ); the pattern of saving and time deposits behaviour is used to establish the relativities using saving-MQUAZ ratio.

The nominal GDP, which is the product of the price level and the real GDP, is obtained from Ghana's policy framework paper (PFP), budget statements and development plans, or it can be derived from a macro model of Ghana (Dordunoo, 1995b).

It is noteworthy that there is not much need for concern about the composition of the liabilities side of the balance sheet. It is important, however, to exclude deposits that are savings and allow the public and banks to decide how they may divide up the narrow money between cash and deposits.

Selected monthly/quarterly leading indicators

The most important leading indicators to be monitored in order to detect whether the targets are on track are the foreign exchange rate and the rate of inflation (Dordunoo, 1994a). The foreign exchange rate developments may be a result of excess credit creation or monetary growth vis-a-vis a shortfall in foreign exchange supply on the market; they therefore, signal the need to apply the monetary breaks through the instrumental variables.

The next indicator is the rate of inflation (Dordunoo, 1995a). It is important to note, however, that the path traced by growth in nominal monetary stock and inflation rates reveals a lag structure. This makes it difficult to rely on the inflation rate as the only leading indicator. The joint use of the rates of inflation and depreciation may give a better idea of the trend of monetary growth – whether there is excess or shortage in money supply to meet the desired growth in money demand.

VIII. Conclusions

After a decade of adjustment we propose in this study that financial programming must be based on the absorptive capacity of the economy endogenously derived, a removal of direct credit ceilings, and an institutionalization of an indirect control of targets using operating intermediate instruments, the open market operations (OMOs), directives and moral suasion.

It is apparent from our observations and analysis that the practice of monetary management in Ghana has been fraught with failures. This has affected the structure of incentives in the financial market, causing economic agents to respond in ways that may not result in efficient allocation of scarce financial resources. Moreover, the distortions produced unreliable economic signals (indicators), making it difficult to control the money stock effectively and resulting in overshooting of targets.

We have proposed an alternative monetary management framework that avoids the mistakes (a result of direct controls based on assumed velocity) of the past and introduces a new dimension to the process of monetary management in Ghana. Clearly, the success of our suggested framework hinges on an accurate estimation of the absorptive capacity of the economy as determined by the demand for and supply of money. Although it does not have the attribute of simplicity to commend it as is the current practice in Ghana, it serves to provide better information about the structure of the economy over time – allowing for an improved assessment of how monetary aggregates and money market conditions are related to the economy – and, as a result, better control of the money stock in Ghana.

In the regression equations the point is made about the possibility of spurious correlation. Thus the agenda ahead requires the up-date of the data series and the analysis of the monetary targeting models using the techniques of cointegration and stationarity. This study cannot pretend to provide all the answers to the issue of monetary programming that will guide the management of money in an economy. Nevertheless, it brings some very fundamental issues and the difficulties that may confront financial management in the absence of a good monetary survey.

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Notes

1. The analytical framework reviewed here does not necessarily reflect the general financial programming framework of the Fund as presented in Occasional Paper 55 (IMF, 1987). It is based on the monetary accounting framework and policy stance of Ghana as well as the discussions of the monetary survey with the monetary authority of Ghana.

2. Owing to the caution due to the safety valve created, the targets set in the monetary survey were generally not exceeded. This implies that the credit squeeze was biting more than was stated in the policy framework paper and the monetary survey.

3. The impact analysis of credit ceiling in the rest of this section draws heavily and directly from Dordunoo (1996).

Appendix: Selected money demand equations and historical simulation results

Ordinary least squares estimation

Dependent variable is LNM2
22 observations used for estimation from 1971 to 1992

Regressor	Coefficient	Standard error	T-ratio
INPT	.2926	4.1000	.0714
LNY	.1444	.6091	.2371
DLNCPI	-.4364	.2329	-1.8740
LNDR	-.0373	.1226	-.3046
LNM2(-1)	.8148	.2091	3.8964

R-squared	.7482	F-statistic F(4, 17)	12.6302
R-bar-squared	.6890	SE of regression	.1432
Residual sum of squares	.3488	Mean of dependent variable	6.9689
SD of dependent variable	.2568	Maximum of log-likelihood	14.3711
DW-statistic	1.7768	Durbin's h-statistic	2.6889

Diagnostic tests

* Test statistics*	LM Version	*	F Version	*
* A: Serial correlation *	CHI-SQ(1)	=.1106 *	F(1, 16)=	.0808 *
* B: Functional form *	CHI-SQ(1)	= .0062395 *	F(1, 16)=	.0045391 *
* C: Normality	* CHI-SQ(2)	= 1.0746 *	Not applicable	*
* D: Heteroscedasticity *	CHI-SQ(1)	= 1.5037 *	F(1, 20)=	1.4673 *

A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values

Residuals and fitted values of regression

Based on OLS regression of LNM2 on:

INPT LNY DLNCPI LNDR LNM2(-1)

22 observations used for estimation from 1971 to 1992

Observation	Actual	Fitted	Residual
1971	6.9722	7.0590	-.0868
1972	7.1690	7.0978	.0712
1973	7.1542	7.2438	-.0896
1974	7.1709	7.2396	-.0688
1975	7.2539	7.1821	.0718
1976	7.3035	7.1642	.1393
1977	7.2562	7.0652	.1911
1978	7.2242	7.1164	.1078
1979	7.0344	7.1345	-.1001
1980	6.9038	6.9906	-.0868
1981	6.7526	6.7098	.0428
1982	6.7493	6.8484	-.0991
1983	6.2703	6.5671	-.2968
1984	6.4923	6.3812	.1111
1985	6.7786	6.6724	.1062
1986	6.8651	6.8565	.0086339
1987	6.9655	6.8782	.0873
1988	7.0353	6.9870	.0482
1989	7.0226	7.0742	-.0517
1990	6.9752	7.0283	-.0531
1991	6.8168	7.0587	-.2419
1992	7.1506	6.9614	.1892
MAPE			10.6785

Cochrane-Orcutt method AR (1) Converged after 6 iterations

Dependent variable is LNM2

22 observations used for estimation from 1971 to 1992

Regressor	Coefficient	Standard error	T-ratio
INPT	-.3752	4.8342	-.0776
LNY	.2949	.7807	.3777
DLNCPI	-.4261	.2601	-1.6382
LNDR	-.0743	.1622	-.4577
LNM2(-1)	.7385	.3203	2.3055

R-squared	.7567	F-statistic F(5, 15)	9.3284
R-bar-squared	.6755	SE of regression	.1499
Residual sum of squares	.3371	Mean of dependent variable	6.9689
SD of dependent variable	.2568	Maximum of log-likelihood	13.5872
DW-statistic	1.7882		

Parameters of the autoregressive error specification

U = .1178*U(- 1)+V

(.3112)

T-ratio(s) based on asymptotic standard errors in brackets

Residuals and fitted values of regression

Based on fixed initial value(s) CO-AR(1) regression of LNM2 on:

INPT LNY DLNCPI LNDR LNM2(-1)

22 observations used for estimation from 1971 to 1992

Observation	Actual	Fitted	Transformed residual
1971	6.9722	*NONE*	*NONE*
1972	7.1690	7.1035	.0655
1973	7.1542	7.2696	-.1154
1974	7.1709	7.2576	-.0867
1975	7.2539	7.1703	.0836
1976	7.3035	7.1628	.1407
1977	7.2562	7.0758	.1804
1978	7.2242	7.1270	.0972
1979	7.0344	7.1313	-.0969
1980	6.9038	6.9761	-.0723
1981	6.7526	6.6945	.0581
1982	6.7493	6.8663	-.1170
1983	6.2703	6.5536	-.2833
1984	6.4923	6.3822	.1101
1985	6.7786	6.7042	.0744
1986	6.8651	6.8725	-.0073700
1987	6.9655	6.8813	.0842
1988	7.0353	6.9915	.0438
1989	7.0226	7.0792	-.0566
1990	6.9752	7.0275	-.0523
1991	6.8168	7.0626	-.2457
1992	7.1506	6.9551	.1955
MAPE			10.3049

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